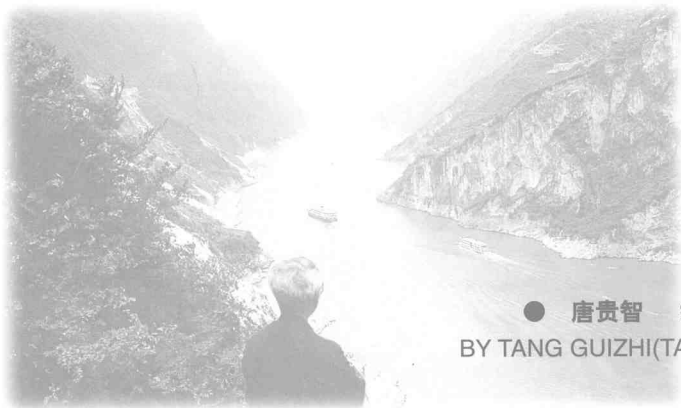


长江三峡地区新构造 地质灾害和 第四纪冰川作用与三峡形成图集

*AN ATLAS OF NEOTECTONICS GEOLOGICAL HAZARDS
AND QUATERNARY GLACIAL GEOMORPHY IN
THE YANGTZE THREE GORGES AREA*



● 唐贵智 编著

BY TANG GUIZHI(TANG K.C.)

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内 容 提 要

本图集系作者根据在80年代调查、研究长江三峡地区新构造运动及其对工程建设影响课题时在野外所拍摄的地质、地貌照片编著而成。

图集运用地质力学理论和方法,较全面地反映了长江三峡地区8万余km²内的基础地质——构造层、活动构造体系形迹及其展布,以及与活动构造体系有着密切成生关系的地质灾害(山崩、滑坡、地震)等一系列重大地质现象。

四个活动体系是本图集的主要内容,也是图集编著者的主要成就之一。编著者根据三峡河谷和沿河谷堆积物的特征与第四纪冰川遗迹对比研究,提出了长江三峡形成与第四纪冰川作用密切相关的新观点,并明确指出三峡形成距今为时不过70万~100万年。

本图集资料主要系野外现场第一手资料,对研究长江三峡地区地质、地貌等自然环境的发生、发展和对三峡大坝工程建成后的影响具有较高的科学价值。

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前言

PREFACE

80年代初, 我受地质矿产部宜昌地质矿产研究所所长谭忠福先生的委托, 从事“长江三峡地区新构造运动及其对工程建设影响”的研究。随即和陶明君开展野外地质调查, 经过7、8年的爬山越岭, 跑遍了面积近80000km²的整个三峡地区, 发现了许多具有重大意义的地质现象。工作中为了查明一个地质问题, 我们还得三番五次地深入现场观测。例如杨家岭第四纪堆覆构造就是这样发现和确定的。而预报新溪复式滑坡发生则是经过8年的观察和研究才取得成功的。由此可见, 任何地质工作成就的取得, 都必须付出艰苦的劳动。类似这样的例子很多, 它们将在图集中分别予以介绍。我们在野外地质调查时, 还拍摄了大量珍贵的地质、地貌照片, 它们如实地记录了地貌、地质现象, 有的照片还是在偶然的机遇下拍下来的, 因此就更具有很珍贵的历史价值。

长江是一条横贯我国东西, 长达6300余千米, 落差近6500m的大江。关于它的发育史, 长期以来各家说法不一, 而解决这一重大地质、地貌问题, 关键在长江三峡的成因和时代。据我们研究, 长江三峡出于晚中新世大冰期之后, 是经过大冰期冰川作用逐渐形成的, 为时不过70万~100万年。以往论述长江三峡地区的地质多侧重于基础地质和矿产资源, 表现形式则以文字为主。至于论述新构造运动和地质灾害则几乎处于空白; 而以图片系统反映三峡地区地质、地貌, 尤不多见。

为了弥补上述不足, 我们将从4000多张野外地质照片中挑选出600多幅具有代表性的照片汇编成本图集, 把长江三峡地区的地质、地貌景观呈现在读者面前, 为读者研究该地区地质环境, 提供了直观素材。

本图集大体分三部分: (一) 新构造运动形迹; (二) 地质灾害; (三) 第四纪冰川地质与三峡形成。为了让读者更好地了解和认识三峡地区的上述地质、地貌内容, 图片均附有简要的文字说明和插图。

本图集的野外地质照片, 主要是陶明君拍摄的。小部分则取自公开发表刊物, 并注明出处。

本图集已编好有几年了, 但出版与否始终犹未决。友人见之, 与其珍藏于手, 不如面世为好, 以供祖国建设服务, 乃决定出版。并向支持者深表谢忱。

I accepted a trust of Mr. Tan Zhongfu the director of the Yichang Institute of Geology and Mineral Resources in early 1980, going in for an investigation on neotectonics of the Yangtze Three Gorges Region on the Yangtze River and its influence on engineering and construction). Mr. Tao Ming and I were timely carrying out field geological survey. As a result of crossing over mountain for seven to eight years running, we walked the area of the whole Yangtze Three Gorges Region about 80 000 square kilometers and found out a great deal of the geologically significant phenomena. In the course of the work, in order to clarifying a geological fact we went usually repeatedly down to work sites making on the spot investigation. The discovery of the Quaternary nappe structure located at the Yangjialing district was one of the example.

The successful forecast of the Xiantan's complex landslide was the result of almost eight years of observation and research. There are many examples in the collection of pictures. Like in other scientific fields, every achievement on geology has to be a result of tremendous physical and mental works. I hope readers can share my pleasant from this collection.

During field geological investigation we taken a great quantity of valuable photographs. These photographs have accurately recorded the geological and geomorphic facts. Some of them was taken by chance and therefore they have great historical value.

The Yangtze River is the longest river in China traversing from west to east for more than 6 300 kilometers long and having a drop of above 6 500 meters. With respect to its evolutionary history, the various researchers have different views for a long time past, we think that the key to this significant question is to determine the genesis and formed age of the Yangtze Three Gorges on the Yangtze River. Based on our investigation, they would be principally appeared after middle Pleistocene Dagu glacial age and were gradually being formed by the glaciation during the Dagu glacial age. Thus their formed age were not likely more than 0.7~1.0 Ma.

The previous geological discussion on the Yangtze Three Gorges Region was emphasized on elementary geology and mineral resources. The literal writing dominated those discussions whereas the researches on the neotectonics and geological hazards were very rare and systematical pictures were scarcely seen. In order to remedy the above defects, we choose representative 500 or more from more than 4 000 field geological pictures and compiled them into a collection of pictures. We believe that the geological and geomorphic landscapes displayed in these pictures will offer an efficient view for the readers researching the geological environment of the Yangtze Three Gorges Region.

Present collection of pictures is roughly divided into three parts: (1) the traces of neotectonics, (2) the geological hazards, and (3) the Quaternary glacial geology.

For the sake of better understanding and recognizing the geological and geomorphic features of the Yangtze Three Gorges Region, all pictures are provided with brief explanation in which some of them are attached with sketch maps also.

Most of field geological pictures were drawn by Mr. Tao Ming and a fraction are quoted from the publications that sources are given.

The manuscripts of this collection of pictures have been completed for several years but I did not decide whether it should be published or not. Some of my close friends catch sight of this manuscript and think that these pictures are very valuable and they suggest to publish it. As a result, I decide to publish this collection of the pictures and hereby express our thanks to the supporters.

The author is grateful to thank Mr. Tu Shaoxing for translation this preface.



唐贵智研究员
Professor of Geology Tang
Guizhi (Tang K.C.)

作者自传 AUTOBIOGRAPHY

我是越南归国华侨，1919年出生于湖南省资兴市，1943年毕业于中山大学地质系，获理学学士学位。1943~1947年在福建省地质土壤调查所从事以县为单位的地质矿产调查，为福建地质事业作出过一定的贡献。1948年为治病回越南。是年与张妙琼女士结婚，她是我事业上的精神支柱。新中国成立后，1951年回国。初在广州地质调查所从事广西锰矿勘察工作；1953年奉中央人事命令调往军委海军北海舰队工程队从事国防工程建设。在海军工作期间，不仅提供了准确的地质资料，确保工程建设顺利，连苏联专家也大为赞赏，认为北海舰队基地的工程勘察是全海军最好的。此外我还在工程施工中提出许多合理化建议，加快了国防建设速度。这些建议后来在全军推广。正由于我工作业绩突出，一年后被破格提升为高级工程师。1980年底我调回地质部河北省地质局，1982年

在处理保定安各庄大型水库遗留工程中，采用我的建议，加快了工程施工速度，在保证工程质量的同时还节约了大量投资，并经受住了1963年特大洪水的考验，保证了保定市及京广铁路的安全。1963年底调湖南长沙中南地质科学研究所（即宜昌地质矿产研究所前身）。不久即赴湘西怀化参加农村社教工作，我具体负责怀化农田水利建设，在短短一年多时间内，在改善怀化县及邻区农田水利灌溉条件，为当地农民摆脱长期旱涝欠收的困境作出了贡献，受到当地政府和农民的高度赞扬。在整整十年文革期间，由于我是归国华侨又有海外关系，自然受到难以忍受的冲击，然而我并未忘怀地质事业。70年代初，根据宜昌地区地质分析，我曾先提出了仍在活动的黄陵旋卷构造，进一步指出它的地应力将对正在建设中的葛洲坝坝址工程——大坝产生不利影响，并于1976年冒着极大的风险写信给《人民日报》，提出这一问题，并请勘察、设计和施工单位予以注意。一年后（1976年），在二江基坑施工中，果然出现了由于地应力作用而产生的边坡变形，其特点与我所预测的完全一致。事后我提出加强坝体安全的建议，经实施，收到良好效果。1980年长阳溃坝大海啸，因事先我建议及时，使二百余人安然无恙。1985年我根据新滩大海啸的时空规律，准确预报了滑坡警报，政府及时采取了防范措施，使镇上1400余人无人伤亡，江上航行的上下客轮避开了冲击，这在三峡地区地质灾害预报成功还是首次。1986年参加全国专家组考察三峡时，我曾对巴东县领导指出，巴东新、旧县城城址为大海啸体，不宜兴建新县城，然而当时并未引起重视，结果90年代一次大雨后即酿成滑坡——泥石流，造成人员伤亡及数千万元经济损失。

因工作成绩优异，我曾二次荣获国务院奖励和奖状。

以上事件在图集中皆有反映和记载。

此图集是我50余载地质生涯的缩写。它凝结了我多年来在三峡地区野外工作的心血和成果。出版这本图集，为祖国建设留下有价值的资料，这是我有生之年的最大愿望。

2000年3月于宜昌

唐貴智同志：

勤心苦練
而不舍
實踐實踐
真出碩果

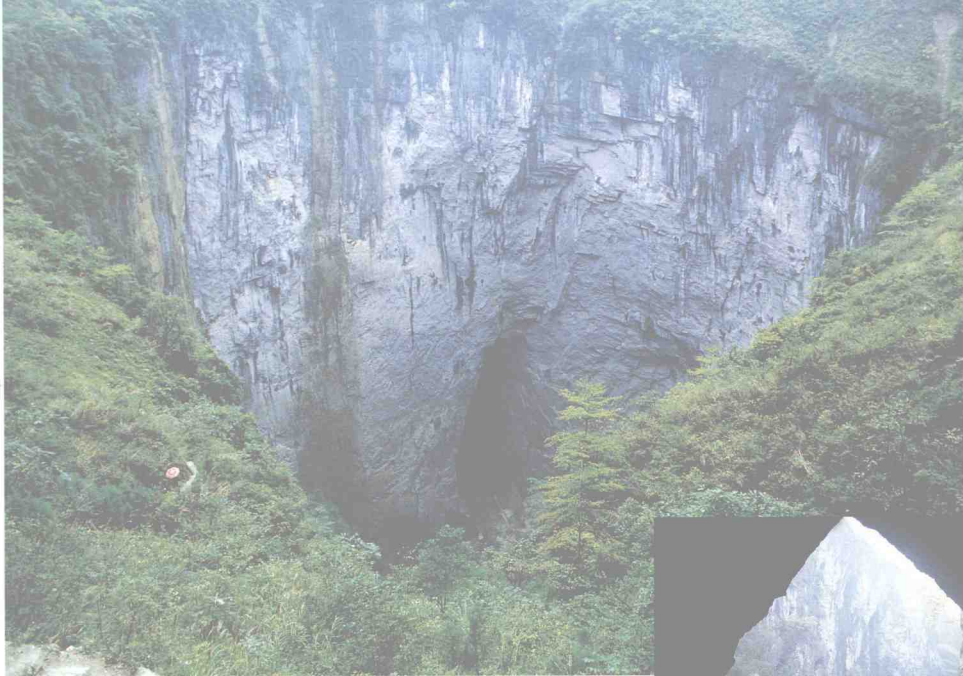
楊遵儀敬賀
一九九九年七月



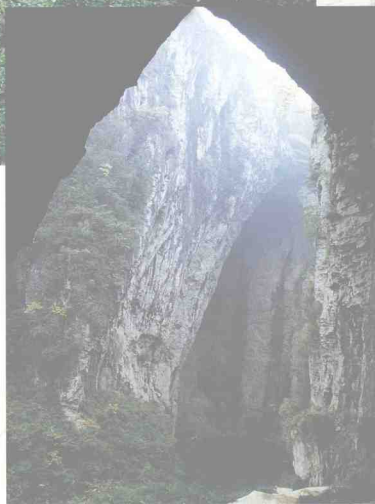
恩師楊遵儀院士題詞
Inscription by academician Yang Zunyi

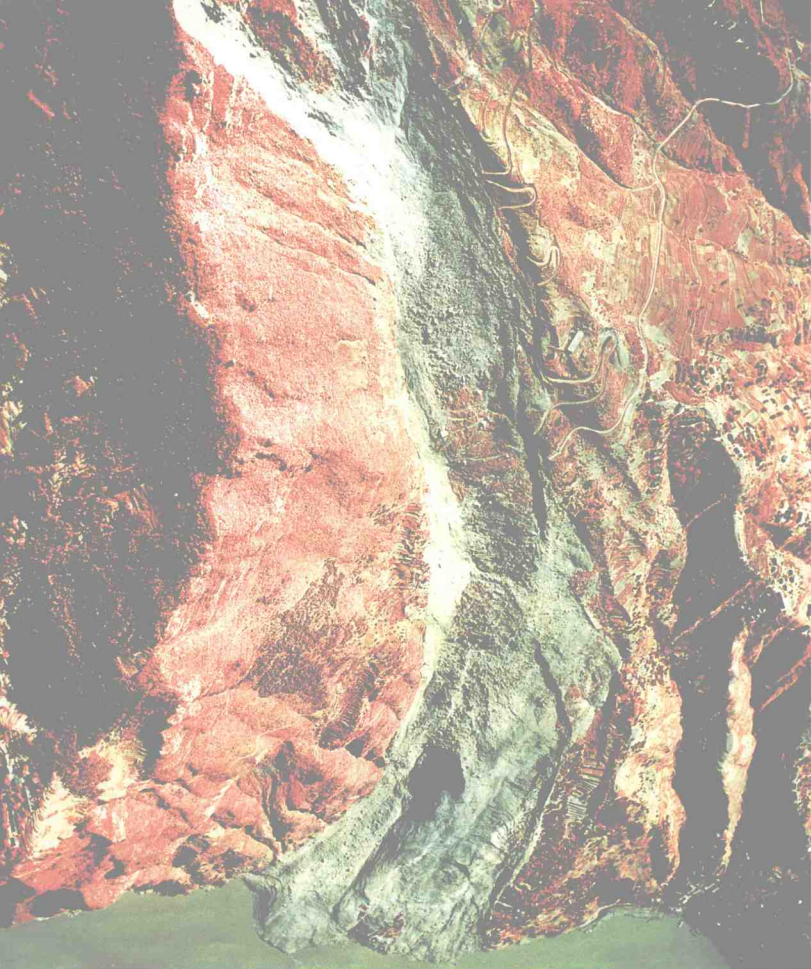


长江三峡地区卫星图 A satellite imagery of Y.T.G.A.



世界上最大的岩溶漏斗—奉节天坑 上图系坑口，坑口直径626m；下图为坑底一角，坑深666.2m
The greatest karst doline in the world, Fengjie.





新滩复式滑坡（航片）据张雍 发生于1985年6月12日凌晨
An aerial photo of Xintan landslide (X.T.L. After Zhang) June 1985.

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通 论

GENERAL REVIEW

一、长江简介

长江全长6300km,落差6500余米,是我国第一大江。根据不同的地质、地貌单元,长江大体分为六个河段。

从源头格拉丹冬(H.6 821m)山谷冰川至当曲河口,长约380km,称为沱沱河。由当曲河至玉树巴塘河口,长近850km,名叫通天河。从巴塘河口至岷江口宜宾是为著名的金沙江,全长2310km。由宜宾至奉节(有的划分至宜昌)全长800km,通称川江。奉节经三峡至宜昌长200余km为峡江。宜昌以下直达吴淞口或称“长江”或称“扬子江”,长1750km。

在此需提出讨论的是川江源问题。有的学者认为从东向西流的古川江的源头是来自奉节的草堂河水系。编者根据沿陵以西至重庆、宜宾沿江一带高地(Ⅲ级或Ⅳ级以上)堆积物的物质成分,以及对谷跨越NNE—NE向川东弧形构造带和宜宾以西在安宁河、雅砻江、龙川江等宽广大河谷内的深厚冲积层以及元谋盆地、右鼓古河道的堆积物和当时高程不超过500m左右等事实分析,认为从东向西流的古川江源应是来自贵州高原的长1180km的乌江。

发源于贵州高原西北草堂的乌江,沿大娄山南麓向东流至思南受阻于梵净山古老结晶岩体,折向北流,至彭水改向西北流,至沿陵与来自奉节草堂河水系相汇,继续向西和南西逆长江(川江)而上,经重庆、宜宾(参见图1)、元谋转向南流顺红河谷入海,这就是古川江自东向西入海的流路。

A. SYNOPSIS OF THE YANGTZE RIVER (BRIEF)

The Yangtze River is the longest river in China, with a length of 6300km, and fall about 6500m. From the river head to the sealevel, and the drainage area is $180 \times 10^4 \text{ km}^2$. Based on different geological and geomorphic features from upper to lower the river is divided into six segments: Tuotuohe River, Tongtianhe River, Jinshajiang River, Chuanjiang River, Xiangjiang River and Yangtze River.

In my opinion it is necessary to point out that the river head of the ancient Chuanjiang River which flowed from E. to W. was ancient Wujiang River which was from Guizhou Plateau but not from Caotang He River which from the Yangtze Gorge, showing in fig.1.

图1: 古川江流路示意图
Fig.1: A Sketch Map of Ancient Chuanjiang River Course

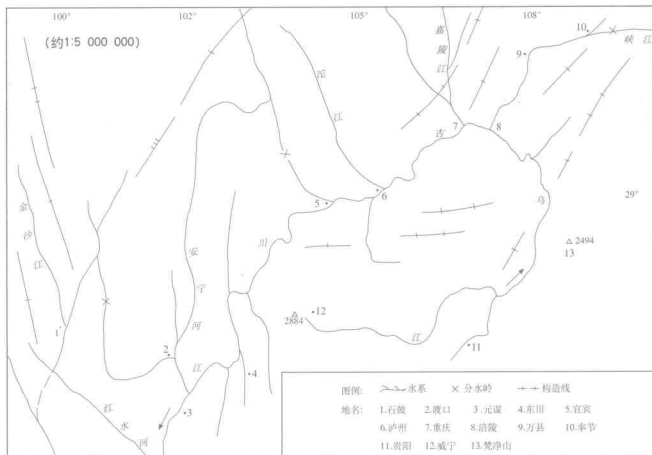


图2: 长江流域示意图图 Fig.2: A Sketch Map of the Yangtze River Drainage Provinces, after the Guangming Daily.

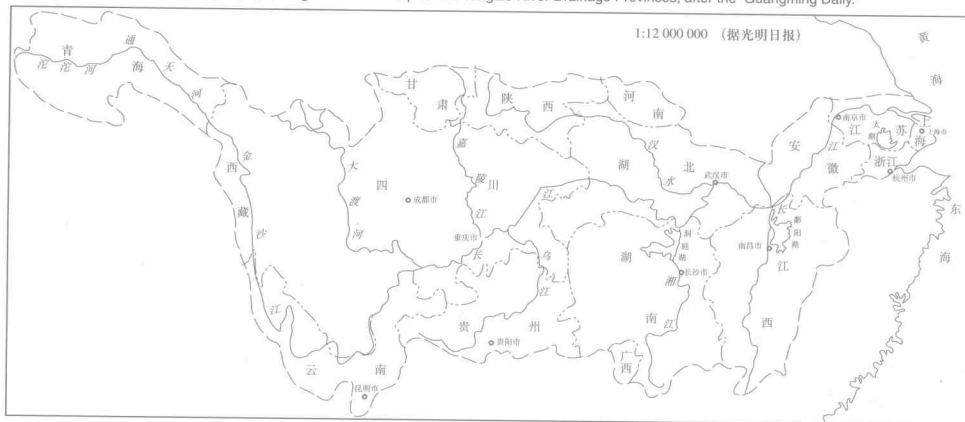
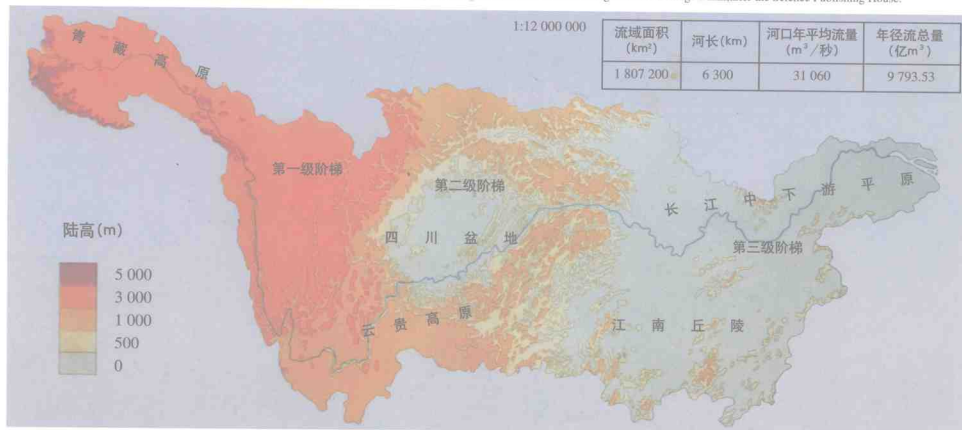


图3: 长江流域等高面示意图 (据长江三峡生态与环境地图集) Fig.3: A Map of Relief Units of the Yangtze River Drainage Basin, after the Science Publishing House.



二、长江三峡简介

长江三峡(以下简称三峡)是瞿塘峡、巫峡、西陵峡的总称。西起奉节白帝城,东至宜昌南津关,全长200km。瞿塘峡长8km,雄壮居三峡之冠。秀丽的巫峡长42km,最长西陵峡75km。构成三峡的主要岩层为灰岩(厚2 500~3 000m)和碎屑岩(厚2 000~2 500m)。前者多形成高峰深槽峡谷,如夔门、神女十二峰和兵书宝剑峡等;后者多为宽缓谷地,如新滩。

三峡对合的摆动明显受新构造运动的控制,如奉节至香溪段对合因受齐岳山—巫山带构造水平扭动的影响明显向北迁移,而香溪至涪陵间对合则受黄陵地块向西南推挤的影响向南偏移。

三峡沿江地势的山顶连线略呈不对称抛物线,其最高点,既不在三峡之中央,也不在黄陵背斜的轴部,而偏居三峡之西端瞿塘峡—巫峡一带。这里山顶高程达1 600~1 800m,峡谷的切割深度也在1 300m以上,水深逾80m。沿峡谷地势高度由此向西东两侧逐渐降低。向西至云阳一带,两岸丘陵顶高程为700~800m;向东至南津关一带,两岸丘陵顶高程仅350~250m。

峡区长江河床基岩起伏很大,沿江急滩暗礁罗列,反映三峡地区地壳上升速度大于河流下切速度。两岸支流多为源短急流,坡度大。仅少数支流显示融岩峰谷的特点,如巫峡十二峰中的官渡对台呈缝状V形,谷底十余米,而谷底宽只有2~80m,这种深切峡谷,只有在地上上升速度较快的情况下才可出现。此外也有长江支流袭夺清江水系的现象(参见图30~32)。

有关长江三峡成因和时代,详见本文论文《论长江三峡形成与大冰期冰川作用的关系》,载1997年《华南地质矿产》所刊。

这里所展出的长江三峡对合的图片和插图,对了解和分析长江三峡的成因和时代,将有很大的帮助。

B. SYNOPSIS OF THE YANGTZE THREE GORGES

The well-known Yangtze Three Gorges (Qutangxia Gorge, Wuxia Gorge and Xilingxia Gorge) and located between latitude 29.40 to 33.00°N and longitude 108.20 to 112.00°E, with total area about $8 \times 10^6 \text{ km}^2$. The Yangtze Three Gorges extend nearly 200km in length. The strata which exposed in the Y.G.A are composed of carbonates (total thickness is about 2 500~3 000m) and sand shales (total thickness about 2 000~2 500m). The form and swing of the Y.T.G. valley are controlled by strength of rocks and Neo-tectonics.

The genesis and age of the Y.T.G. Valley had recently been discussed by the author in *A Discussion of Relationship between the M. Pleistocene Glaciation and formation of the Yangtze Three Gorges* No.4, 1997

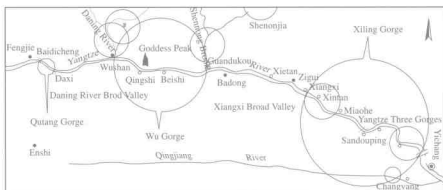


图4-A: 长江三峡河谷略图 (据姚华舟)

Fig.4-A: A geographical divisions of the scenic spots in the Yangtze Three Gorges Area.

图4-B: 长江三峡地貌图

Fig.4-B: A geomorphological map of the Yangtze Three Gorges Area

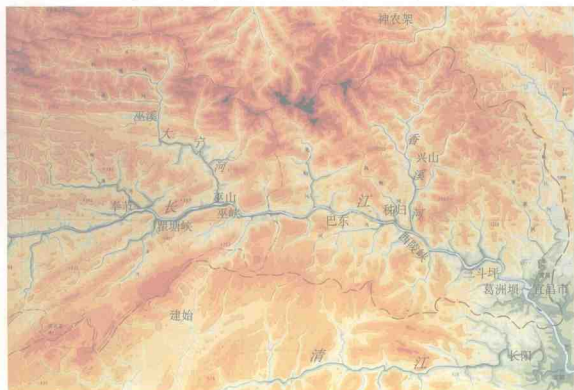
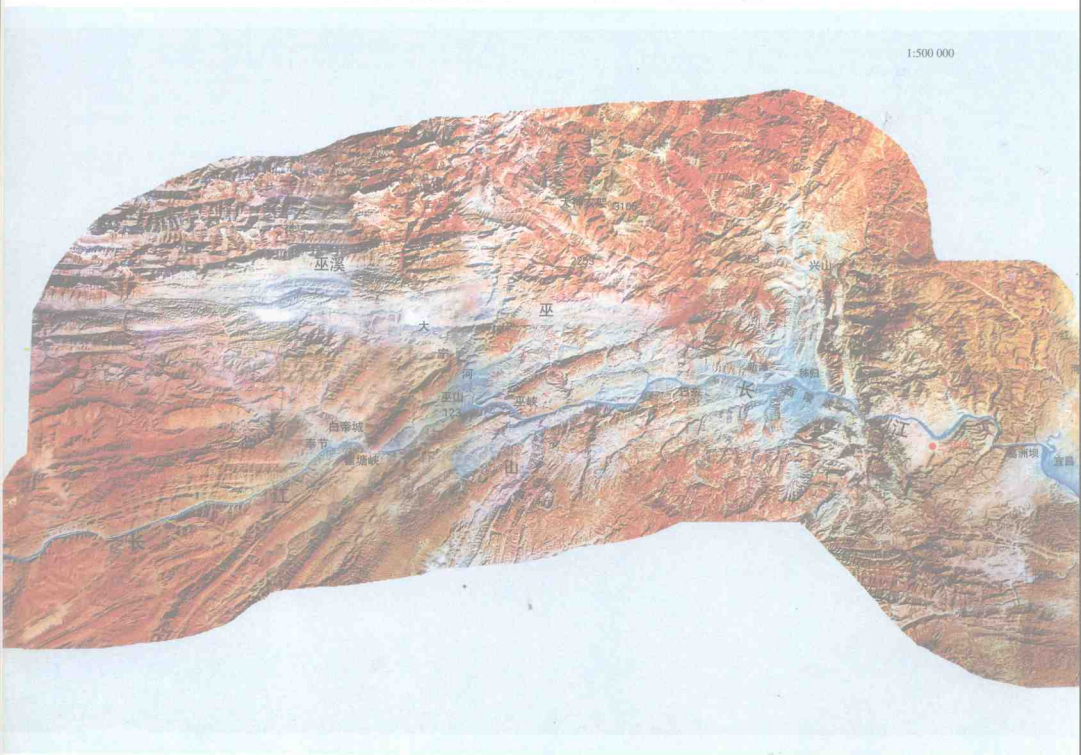


图4: 长江三峡河谷卫片图 Fig.4: A satellite imagery of the Yangtze Three Gorges.



三峡卫星像片: 像片显示河谷形态与构造关系。当河谷切割灰岩和构成造线时, 多成雄伟峡谷; 而与构造线平行和非灰岩区时多成宽谷。
V-shaped valley formed by the river across the Ls area and structural line and open valley as the river parallel the line of shale area and structure.

图5-A: 长江三峡地形略图(山脉、水系展布) Fig.5-A: Geomorphological map of the Yangtze Three Gorges Area.



图5-B: 三峡沿谷著名景观分布图(据宜昌市长江三峡旅游图, 1983年) Fig.5-B: Scenes spots in the Yangtze Three Gorges Valley.



图6：奉节—宜昌段长江河谷纵剖面理想图

Fig.6: An Idealized longitudinal profile of Fengjie-Yichang, along the Yangtze River Valley.

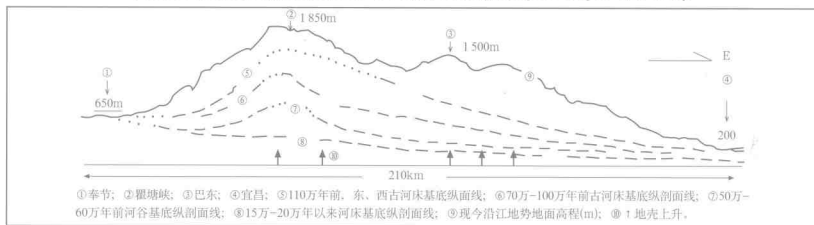


图6-A： 长江三峡段河谷阶地相示意图(据湖北水文地质大队资料改编)

Fig.6-A: Terraces distribution along the Yangtze Three Gorges Valley(Chongqing to Yichang).

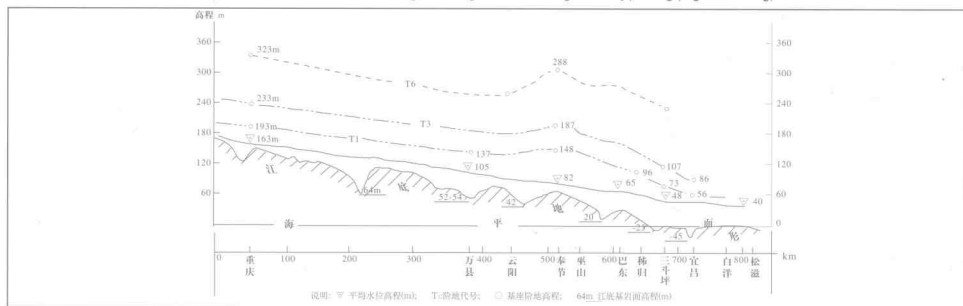


图7：通过绿葱坡—神农架—武当山横跨长江河谷理想剖面图

Fig.7: An idealized cross profile of the Yangtze River Valley from Luzhonpo to Wudangshan.

